

APPLICANT(S): STELLACCI, Francesco

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AMENDMENTS TO THE CLAIMS

Please add or amend the claims to read as follows, and cancel without prejudice or disclaimer to resubmission in a divisional or continuation application claims indicated as cancelled:

Claims

1. (Previously Presented and Currently Amended) A method of forming a complement image of a master, comprising the steps of:

- a) providing a master that comprises a first set of molecules bound to a first substrate to form a pattern;
- b) assembling via attractive forces or bond formation a second set of molecules on the first set of molecules, wherein each molecule in the second set of molecules comprises:
 - i) a reactive functional group; and
 - ii) a recognition component that is attracted to or binds to one or more of the first set of molecules; and
 - iii) optionally a covalent bond or a first spacer that links the reactive functional group to the recognition component.
- c) contacting the reactive functional group of the second set of molecules with a surface of a second substrate, thereby forming a bond between the second set of molecules and said surface of a second substrate such that the second set of molecules are attached to said surface of said second substrate by bonds that are stable to conditions that will break the bonds between the first and the second set of molecules;
- d) breaking the attractive force or bonds between the first set of molecules and the second set of molecules by applying heat or by using a solution such as a solution having a high ionic strength or a combination thereof, or by contacting said molecules with a solution containing an enzyme, or by applying a magnetic field, thereby forming a complement image

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of the master; and

- e) optionally repeating steps b) through d) one or more times.

2. (Cancelled)

3. - 39. (Cancelled)

40. (Previously Presented) The method of Claim 1, further comprising the steps of:

- a) forming a pattern of one or more metal, metal oxide, or combinations thereof on a surface of a substrate using electron beam lithography;
- b) contacting the surface with the first set of molecules, wherein each molecule of the first set of molecules has a reactive functional group that forms a bond between the metal or metal oxide and the molecules of the first set of molecules, thereby forming a master that comprises a first set of molecules bound to the substrate to form a pattern.

41.-48. (Cancelled)

49. (Previously Presented) The method of Claim 1, wherein at least one portion of the second substrate surface is free of the second set of molecules.

50. (Original) The method of Claim 49, further comprising the steps of:

- a) contacting the surface of the second substrate with a reactant selected to be chemically inert to the second set of molecules and to degrade at least the surface layer of the second substrate, thereby degrading the portion of the surface of the second substrate that is free of the second set of molecules; and
- b) removing the second set of molecules to uncover a portion of the surface of the second substrate.

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51. (Cancelled))

52. (Original) The method of Claim 49, further comprising the steps of:

- a) depositing a material on the portion of the second substrate surface that is free of the second set of molecules; and
- b) removing the second set of molecules to uncover a portion of the surface of the second substrate.

53.-56. (Cancelled)

57. (Previously Presented and Currently Amended) A method of forming a reproduction of a master, or portion thereof, comprising the steps of:

- a) providing a master that comprises a first set of molecules bound to a first substrate to form a pattern;
- b) assembling via bond formation a second set of molecules on the first set of molecules, wherein each molecule in the second set of molecules comprises:
 - i) a reactive functional group; and
 - ii) a recognition component that binds to the first set of molecules; and
 - iii) optionally a covalent bond or a first spacer that links the reactive functional group to the recognition component.
- c) contacting the reactive functional group of the second set of molecules with a surface of a second substrate, thereby forming a bond between the second set of molecules and said surface of a second substrate such that the second set of molecules are attached to said surface of said second substrate by bonds that are stable to conditions that will break the bonds between the first and the second set of molecules;
- d) breaking the bonds between the first set of molecules and the second set of molecules by applying heat or by using a solution such as a solution

- having a high ionic strength or a combination thereof, or by contacting said molecules with a solution containing an enzyme, or by applying a magnetic field, thereby forming a complement image of the master;
- e) assembling via bond formation a third set of molecules on the second set of molecules of the complement image, wherein each molecule in the third set of molecules consists of:
 - i) a reactive functional group; and
 - ii) a recognition component that binds to the second set of molecules; and
 - iii) optionally a covalent bond or a first spacer that links the reactive functional group to the recognition component.
 - f) contacting the reactive functional group of the third set of molecules with a surface of a third substrate, thereby forming a bond between the third set of molecules and said surface of a third substrate such that the third set of molecules are attached to said surface of said third substrate by bonds that are stable to conditions that will break the bonds between the second and the third set of molecules;
 - g) breaking the bonds between the second set of molecules and the third set of molecules by applying heat or by using a solution such as a solution having a high ionic strength or a combination thereof, or by contacting said molecules with a solution containing an enzyme, or by applying a magnetic field, thereby forming the reproduction of the master, or portion thereof; and
 - h) optionally repeating steps e) through g) one or more times.

58. (Cancelled)

59.-96. (Cancelled)

97. (Previously Presented) The method of Claim 57, further comprising the steps

of:

- a) forming a pattern of one or more metal, metal oxide, or combinations thereof on a surface of a substrate using electron beam lithography;
- b) contacting the surface with the first set of molecules, wherein each molecule of the first set of molecules has a reactive functional group that forms a bond between the metal or metal oxide and the molecules of the first set of molecules, thereby forming a master that comprises a first set of molecules bound to the substrate to form a pattern.

98.-105. (Cancelled)

106. (Previously Presented) The method of Claim 57, wherein at least one portion of the third substrate surface is free of the third set of molecules.

107. (Original) The method of Claim 106, further comprising the steps of:

- a) contacting the surface of the third substrate with a reactant selected to be chemically inert to the third set of molecules and to degrade at least the surface layer of the third substrate, thereby degrading the portion of the surface of the third substrate that is free of the third set of molecules; and
- b) removing the third set of molecules to uncover a portion of the surface of the third substrate.

108. (Cancelled)

109. (Original) The method of Claim 106, further comprising the steps of:

- a) depositing a material on the portion of the third substrate surface that is free of the third set of molecules; and
- b) removing the third set of molecules to uncover a portion of the surface of the third substrate.

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110. (Cancelled)

111. (Withdrawn) A composition, comprising:

- a) a master comprising a pattern of a first set of molecules bound to a first substrate; and
- b) a complement image comprising a pattern of a second set of molecules bound to a second substrate via a reactive functional group on each molecule of the second set of molecules, wherein each molecule in the second set of molecules has a recognition component that binds to at least a portion of a molecule from the first set of molecule.

112. (Withdrawn) The composition of Claim 111, wherein each molecule of the second set of molecule further comprises one or more of the following components:

- a) an exposed functionality;
- b) a covalent bond or a first spacer that links the reactive functional group to the recognition component; and
- c) a covalent bond or a second spacer that links the exposed functionality to the recognition component.

113.-144. (Cancelled)

145. (Withdrawn) A composition, comprising:

- a) a first pattern of a first set of molecules bound to a first substrate; and
- b) a second pattern of a second set of molecules bound to a second substrate via a reactive functional group on each molecule of the second set of molecules, wherein each molecule of the second set of molecules comprises a recognition component that binds to at least one molecule in the first set of molecules, and wherein the second pattern is a complement image of the first pattern.

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146. (Withdrawn) The composition of Claim 145, wherein each molecule of the second set of molecules further comprises one or more of the following components:

- a) an exposed functionality;
- b) a covalent bond or a first spacer that links the reactive functional group to the recognition component; and
- c) a covalent bond or a second spacer that links the exposed functionality to the recognition component.

147.-176. (Cancelled)

177. (Withdrawn) A composition, comprising:

- a) a first pattern of a first set of molecules bound to a first substrate; and
- b) a second substrate, wherein the second substrate comprises a degraded portion and an undegraded portion and is a complement image of the first pattern.

178. (Withdrawn) The composition of Claim 177, wherein the complement image is formed by a method comprising the steps of:

- a) forming a second pattern of a second set of molecules on the second substrate, wherein the second pattern is a complement image of the first pattern, and wherein at least one portion of the second substrate surface is free of the second set of molecules;
- b) degrading the portion of the second substrate that is free of the second set of molecules; and
- c) removing the second set of molecules from the second substrate, thereby exposing the surface of the second substrate.

179. (Withdrawn) A composition, comprising:

- a) a first pattern of a first set of molecules bound to a first substrate; and
- b) a second substrate having a patterned layer of a material deposited

thereon, wherein the patterned layer of deposited material on the second substrate is a complement image of the first pattern.

180. (Withdrawn) The composition of Claim 179, wherein the complement image is formed on the second substrate by a method comprising the steps of;

- a) forming a second pattern of a second set of molecules on the second substrate, wherein the second pattern is a complement image of the first pattern, and wherein at least one portion of the second substrate surface is free of the second set of molecules;
- b) depositing a material on the portion of the second substrate that is free of the second set of molecules; and
- c) removing the second set of molecules from the second substrate, thereby exposing the surface of the second substrate.

181. (Cancelled)

182. (Withdrawn) A kit for printing a molecular pattern on a substrate, comprising:

- a) a master comprising a pattern of a first set of molecules bound to a substrate; and
- b) a second set of molecules, wherein the second set of molecules comprise:
 - i) a reactive functional group; and
 - ii) a recognition component that binds to the first set of molecules.

183. (Withdrawn) The kit of Claim 182, wherein each molecule of the second set of molecules further comprises one or more of the following components:

- a) an exposed functionality;
- b) a covalent bond or a first spacer that links the reactive functional group to the recognition component; and

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- c) a covalent bond or a second spacer that links the exposed functionality to the recognition component.

184.-214. (Cancelled)

215. (Withdrawn) A molecular printer for generating a complement image of a master having a first set of molecules bound to a surface of a first substrate, comprising:

- a) a device for delivering a solution of a second set of molecules to the surface of the master, wherein the second set of molecules comprises:
 - i) a reactive functional group; and
 - ii) a recognition component that binds to the first set of molecules;
- and
- b) a device for contacting the second set of molecules with a second substrate.

216. (Withdrawn) The molecular printer of Claim 215, wherein each molecule of the second set of molecules further comprises one or more of the following components:

- a) an exposed functionality;
- b) a covalent bond or a first spacer that links the reactive functional group to the recognition component; and
- c) a covalent bond or a second spacer that links the exposed functionality to the recognition component.

217.-245. (Cancelled)

246. (Previously Presented and Currently Amended) A method of forming a complement image of a master, comprising the steps of:

- a) providing a master that comprises a first set of molecules bound to a first substrate to form a pattern;
- b) assembling via attractive forces or bond formation a second set of

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molecules on the first set of molecules, wherein each molecule in the second set of molecules consists of:

- i) a reactive functional group; and
- ii) a recognition component that is attracted to or binds to one or more of the first set of molecules; and
- iii) optionally a covalent bond or a first spacer that links the reactive functional group to the recognition component.
- iv) An exposed functionality selected from the group consisting of: antibody, antigen, hapten, enzyme, a substrate for an enzyme, inhibitor, co-factor, protein, lectin, carbohydrate, receptor, hormone, effector, repressor/inducer, or chemical groups such as —OH, —CONH—, —CONHCO—, —NH₂, —NH—, —COOH, —COOR, —CSNH—, —NO₂, —SO₂, —SH, —RCOR—, —RCSR—, —RSR, —ROR—, —PO₄³⁻, —OSO₃²⁻, —SO₃⁻, —COO⁻, —SOO⁻, —RSOR—, —CONR₂, —(OCH₂CH₂)_nOH (wherein n = 1-20, preferably 1-8), —CH₃, —PO₃H⁻, —2-imidazole, —N(CH₃)₂, —N(R)₂, —PO₃H₂, —CN, —(CF₂)_nCF₃ (wherein n = 1-20, preferably 1-8), an olefin; wherein R is hydrogen, a hydrocarbon, a halogenated hydrocarbon, a protein, an enzyme, a carbohydrates, a lectin, a hormone, a receptor, an antigen, an antibody, or a hapten.
- v) optionally a covalent bond or a second spacer that links the exposed functionality to the recognition component.

- c) contacting the reactive functional group of the second set of molecules with a surface of a second substrate, thereby forming a bond between the second set of molecules and said surface of a second substrate such that the second set of molecules are attached to said surface of said second substrate by bonds that are stable to conditions that will break the bonds between the first and the second set of molecules;
- d) breaking the attractive force or bonds between the first set of molecules and the second set of molecules by applying heat or by using a solution such as a solution having a high ionic strength or a combination thereof,

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or by contacting said molecules with a solution containing an enzyme,

or by applying a magnetic field, thereby forming a complement image
of the master; and

- e) optionally repeating steps b) through d) one or more times.

247. (Previously Presented and Currently Amended) A method of forming a reproduction of a master, or portion thereof, comprising the steps of:

- c) providing a master that comprises a first set of molecules bound to a first substrate to form a pattern;
- d) assembling via bond formation a second set of molecules on the first set of molecules, wherein each molecule in the second set of molecules consists of:
- i) a reactive functional group; and
 - ii) a recognition component that binds to the first set of molecules;
and
 - iii) optionally a covalent bond or a first spacer that links the reactive functional group to the recognition component.
 - iv) optionally an exposed functionality selected from the group consisting of: antibody, antigen, hapten, enzyme, a substrate for an enzyme, inhibitor, co-factor, protein, lectin, carbohydrate, receptor, hormone, effector, repressor/inducer, or chemical groups such as —OH, —CONH—, —CONHCO—, —NH₂, —NH—, —COOH, —COOR, —CSNH—, —NO₂⁻, —SO₂, —SH, —RCOR—, —RCSR—, —RSR, —ROR—, —PO₄³⁻, —OSO₃²⁻, —SO₃⁻, —COO⁻, —SOO⁻, —RSOR—, —CONR₂, —(OCH₂CH₂)_nOH (wherein n = 1-20, preferably 1-8), —CH₃, —PO₃H⁻, —imidazole, —N(CH₃)₂, —N(R)₂, —PO₃H₂, —CN, —(CF₂)_nCF₃ (wherein n = 1-20, preferably 1-8), an olefin; wherein R is hydrogen, a hydrocarbon, a halogenated hydrocarbon, a protein, an enzyme, a carbohydrates, a lectin, a hormone, a receptor, an antigen, an antibody, or a hapten.

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- v) optionally a covalent bond or a second spacer that links the exposed functionality to the recognition component.
- c) contacting the reactive functional group of the second set of molecules with a surface of a second substrate, thereby forming a bond between the second set of molecules and said surface of a second substrate such that the second set of molecules are attached to said surface of said second substrate by bonds that are stable to conditions that will break the bonds between the first and the second set of molecules;
- f) breaking the bonds between the first set of molecules and the second set of molecules by applying heat or by using a solution such as a solution having a high ionic strength or a combination thereof, or by contacting said molecules with a solution containing an enzyme, or by applying a magnetic field, thereby forming a complement image of the master;
- g) assembling via bond formation a third set of molecules on the second set of molecules of the complement image, wherein each molecule in the third set of molecules consists of:
 - i) a reactive functional group; and
 - ii) a recognition component that binds to the second set of molecules; and
 - iii) optionally a covalent bond or a first spacer that links the reactive functional group to the recognition component.
 - iv) An exposed functionality selected from the group consisting of: antibody, antigen, hapten, enzyme, a substrate for an enzyme, inhibitor, co-factor, protein, lectin, carbohydrate, receptor, hormone, effector, repressor/inducer, or chemical groups such as —OH, —CONH—, —CONHCO—, —NH₂, —NH—, —COOH, —COOR, —CSNH—, —NO₂—, —SO₂—, —SH, —RCOR—, —RCSR—, —RSR, —ROR—, —PO₄³⁻, —OSO₃²⁻, —SO₃⁻, —COO⁻, —SOO⁻, —RSOR—, —CONR₂—, (OCH₂CH₂)_nOH (wherein n = 1-20, preferably 1-8), —CH₃, —PO₃H⁻, —2-imidazole, —N(CH₃)₂, —N(R)₂, —PO₃H₂, —CN, —(CF₂)_nCF₃ (wherein n =

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1-20, preferably 1-8), an olefin;

wherein R is hydrogen, a hydrocarbon, a halogenated hydrocarbon, a protein, an enzyme, a carbohydrates, a lectin, a hormone, a receptor, an antigen, an antibody, or a hapten.

v) optionally a covalent bond or a second spacer that links the exposed functionality to the recognition component.

- f) contacting the reactive functional group of the third set of molecules with a surface of a third substrate, thereby forming a bond between the third set of molecules and said surface of a third substrate such that the third set of molecules are attached to said surface of said third substrate by bonds that are stable to conditions that will break the bonds between the second and the third set of molecules;
- g) breaking the bonds between the second set of molecules and the third set of molecules by applying heat or by using a solution such as a solution having a high ionic strength or a combination thereof, or by contacting said molecules with a solution containing an enzyme, or by applying a magnetic field, thereby forming the reproduction of the master, or portion thereof; and
- h) optionally repeating steps e) through g) one or more times.